KEY

HONORS PHYSICS MIDTERM
FORMAT AND MAJOR TOPICS

EXAM SCORING

55 Multiple Choice 55%

There will be ***no* partial credit** given for any work shown. Only the correctly chosen answers in the scan sheet will be given the proper credit.

3 Free Response (15 points each) 45%

Complete each of the problems with correct units. SHOW ALL WORK!

Topics for testing include:

Ch. 1 Introduction
- Measurement & Uncertainty
- Units, Standards and the SI system
- Converting Units
- Mathematics in physics

Ch. 2 Describing Motion: Kinematics in One Dimension
- Reference fames and displacement
- Average Velocity
- Instantaneous Velocity
- Acceleration
- Motion at constant acceleration
- Falling Objects
- Graphical analysis of linear motion

Ch. 3 Kinematics in Two Dimensions; Vectors
- Vectors and Scalars
- Addition and Subtraction of Vectors Graphically and Analytically
- Multiplication of a vector by a scalar
- Projectile Motion
- Relative Velocity

Ch. 4 Motion and Force
- Force
- Newton's 3 Laws of Motion
- Mass
- Weight
- Problem Solving w/ Newton's Laws
- Free-body Diagrams
- Friction & Inclines

Ch. 5 Circular Motion; Gravitation
- Kinematics of Uniform Circular Motion
- Dynamics of Uniform Circular Motion
- Non-Uniform Circular Motion
- The Fundamental Forces

2. $\frac{54.9 \text{ miles}}{1 \text{ hour}} \Big/ \frac{1.61 \text{ Km}}{1 \text{ mile}} \Big/ \frac{1000 \text{ m}}{1 \text{ Km}} \Big/ \frac{1 \text{ hr}}{3600 \text{ s}} =$

Practice Problems: For more problems go to:
http://wps.prenhall.com/esm_giancoli_physicsppa_6/16/4351/1114009.cw/index.html

1. A 10.0 L container has a volume expressed in cubic meters of 0.01 m^3

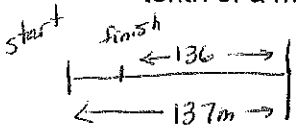
$$\frac{10.0 \text{ L}}{1} \Big/ \frac{1000 \text{ mL}}{1 \text{ L}} \Big/ \frac{1 \text{ cm}^3}{1 \text{ mL}} \Big/ \left(\frac{1 \text{ m}}{100 \text{ cm}}\right)^3$$

2. Convert 54.9 mph to m/s 24.6 m/s

3. Given that 1 angstrom unit = 10^{-10} meters and 1 fermi = 10^{-15} meters, what is the relationship between these units?

$1 \text{ angstrom} = 1 \times 10^5 \text{ fermi}$

4. A runner dashes from the starting line (x = 0) to a point 137 m away and then turns around and runs to a point 1 m away from the starting point in 17 seconds. To the nearest tenth of a m/s what is the average speed?



total distance $136 + 137 = 273 \text{ m}$

$$s = \frac{d}{t} \quad \frac{273 \text{ m}}{17 \text{ s}} = 16.1 \frac{\text{m}}{\text{s}}$$

5. A car traveling at 18 m/s accelerates at 1.12 m/s^2 for 12 seconds. To the nearest meter how far does it travel?

$\vec{v}_i = 18 \text{ m/s}$

$\vec{a} = 1.12 \text{ m/s}^2$

$t = 12 \text{ s}$

$$\Delta x = v_i t + \frac{1}{2} a t^2$$

$$\Delta x = (18)(12) + \frac{1}{2}(1.12)(12)^2$$

$$\Delta x = 216 \text{ m} + 80.64 \text{ m} \qquad \Delta x = 297 \text{ m}$$

6. Using the graph below where is Car C with respect to Car D at time equals 10 seconds?

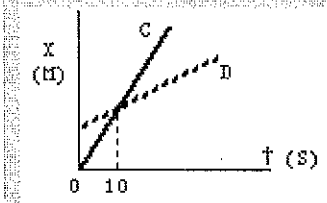


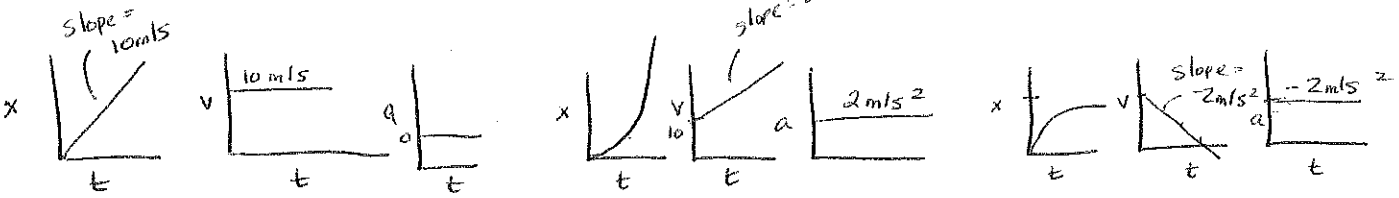
Figure 2-1

it's a position-time graph - they are at the same spot

At t = 0 s

7. Draw a position time graph, velocity time graph and an acceleration time graph representing each of the following conditions.

V_i = +10 m/s	v_i = 10 m/s	v_i = 10 m/s
A = 0 m/s	a = 2 m/s^2	a = -2 m/s^2



8. An object is shot upward at 34.3 m/s. How high does it go? $V_f^2 = V_i^2 + 2gd$

$V_i = 34.3 m/s$

$g = -9.8 m/s^2$

$\Delta y = \frac{V_f^2 - V_i^2}{2g}$ $\Delta y = \frac{0 - 34.3^2}{2(-9.8)} = 60.0m$

9. A ball is dropped off a ledge. How far does it fall in the 2nd second?

$t_1 = 1$ 1st second $\Delta y = \frac{1}{2}gt^2 = 4.9m$

$t_2 = 2$ 2nd second

$\Delta y = \frac{1}{2}g(4) = 19.6m$ > $14.7m$

10. A vector of magnitude 10 m/s has an angle with the positive x-axis of 120 degrees. What are its components?

$$V = -5\frac{m}{s}\hat{x} + 8.66\frac{m}{s}\hat{y}$$

11. A vector has components x = -2 m and y = -2 m. What is its direction (angle with respect to positive x axis)?

$V = \sqrt{(-2)^2 + (-2)^2}$

$V = 2.828\frac{m}{s}$

$\theta = \tan^{-1}\left(\frac{-2}{-2}\right) = 45^\circ$ or 225°

negative

$\vec{V} = 2.83\frac{m}{s} @ 45^\circ SW$

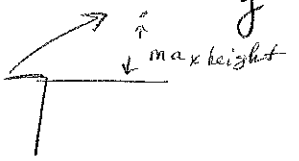
or

$\vec{V} = 2.83\frac{m}{s} @ 225^\circ$

12. A ball is thrown with a speed of 29 m/s and at an angle of 43 degrees. How high does it go above the cliff to the nearest tenth of a meter?

$V_x = 21.21 \frac{m}{s}$

$V_y = 19.78 \frac{m}{s}$



$V_{fy}^2 = V_{iy}^2 + 2g\Delta y$

$0 = (19.78)^2 + 2(-9.8)\Delta y$

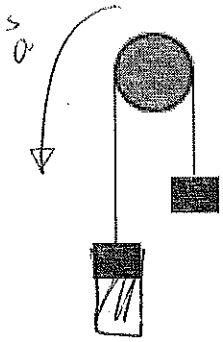
$19.96 = \Delta y$

$20.0\,m = \Delta y$

13.

a) If two identical masses, attached by a massless cord passing over a massless, frictionless pulley of an Atwood's machine (at different heights), are released what is the acceleration of the system? _____

$\vec{a} = 0$



b) If the first mass has 2 times the mass of the 2nd mass what will be the acceleration of the system when released

SYSTEM

$m_1 = 2m_2$

$\Sigma F = ma$

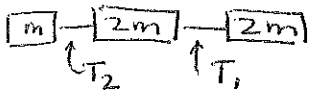
$(m_1 + m_2)a = m_1 g - m_2 g$

$(2m_2 + m_2)a = 2m_2 g - m_2 g$

$3m_2 a = m_2 g$

$a = \frac{g}{3} = 3.27 \frac{m}{s^2}$

$5 m/s^2 \rightarrow$

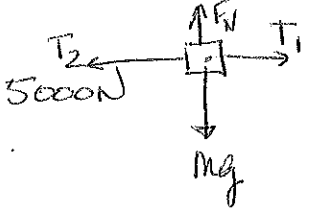


14. A train consists of a caboose (mass = 1000 kg), a car (mass = 2000 kg), and an engine car (mass = 2000 kg). If the train has an acceleration of 5 m/s^2, then the tension force in the coupling between the middle car and the engine car is ....

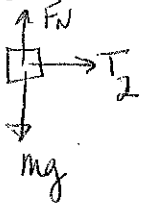
System

Cars

Middle



Caboose



$\Sigma F_x = ma_x$

$(1000)(5) = T_2$

$5000N = T_2$

$\Sigma F_x = ma_x$

$(2000)(5) = T_1 - 5000N$

$10\,000 + 5000 = T_1$

$\boxed{T_1 = 15000N}$

15. A skier traveling at 39.8 m/s encounters a 20.4 degree slope. If you could ignore friction, to the nearest meter, how far up the hill does he go?

$V_i = 39.8 \frac{m}{s}$

$V_f = 0$

$a = -3.42 \frac{m}{s^2}$

$\Sigma F_x = ma_x$

$ma_x = -mg \sin\theta$

$a = (9.8 \sin 20.4)$

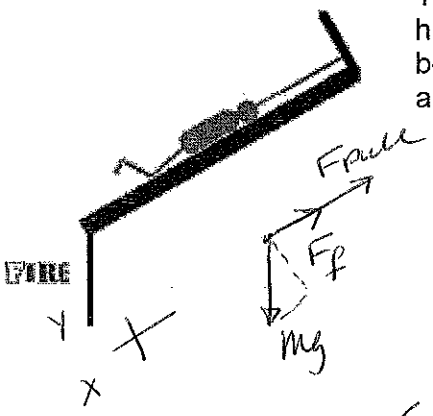
$\vec{a} = -3.42 \frac{m}{s^2}$

$V_{f_x}^2 = V_{i_x}^2 + 2a\Delta x$

$-(39.8)^2 = 2(-3.42)\Delta x$

$\boxed{232m = \Delta x}$

16. You have a mass of 58 kg and are on a 56-degree slope hanging on to a cord with a breaking strength of 190 N. What must be the coefficient of static friction to 2 decimal places between you and the surface for you to be saved from the fire?



$\Sigma F_x = 0$

$0 = F_{pull} + F_f - mg\sin\theta$

$mg\sin\theta = F_{pull} + F_f$

$(58)(9.8)\sin 56 = 190 + \mu(58)(9.8)\cos 56$

$471 = 190 + 317\mu$

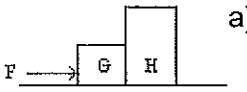
$0.89 = \mu$

$\Sigma F_y = 0$

$0 = \mu mg\cos\theta - F_N$

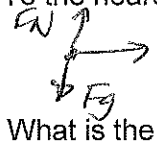
$F_N = \mu mg\cos\theta$

17. Box H has a mass of 21 kg and the box G has a mass of 5.7 kg and the force is 129 N. Assume no friction.



a) To the nearest tenth of a m/s^2 what is the acceleration of the combination?

SYSTEM



$129 = (5.7+21)a$

$4.83\frac{m}{s^2} = a$

b) What is the force of G on H?

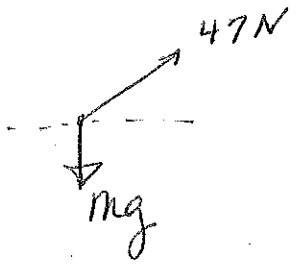
BOX 1

$ma = F_{GH}$

$(21)(a) = F_{GH}$

$101.6\,N = F_{GH}$

18. A child pulls a wagon with a force of 47 N by a handle making an angle of 28 degrees with the horizontal. If the wagon has a mass of 4.3 kg, to the nearest hundredth of a m/s^2 what is the acceleration of the wagon?



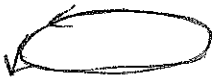
$\Sigma F_x = ma_x$

$ma_x = 47\cos 28°$

$a_x = \frac{47\cos 28}{4.3} = 9.65\frac{m}{s^2}$

19. A girl attaches a rock to a string she then swings counterclockwise in a horizontal circle. The string breaks at point P on the sketch, which shows a bird's-eye view (i.e., as seen from above). What path will the rock follow?

tangent to the path (circular)



19. There are four forces in nature. ELECTROMAGNETIC, GRAVITATIONAL, STRONG, WEAK > NUCLEAR
Which one ...allows you to close a door by pushing on it? EM
...is responsible for radioactive decay? WEAK
...is responsible for the friction on the surface of a table? EM
....causes the orbit of satellites? GRAVITATIONAL
... causes the attraction between the nucleus and the electron? STRONG
.... Causes the attraction between the earth and the sun? GRAVITATIONAL

20. The 61 kg man in the roller coaster car is sitting on a bathroom scale. If he is traveling at 40.2 m/s at the point shown and the radius of the vertical coaster track is 61 meters, to the nearest newton what does the scale read?

TOP

$$\sum F_y = ma_c = F_N + mg$$

$$(61)\left(\frac{v^2}{r}\right) = F_N + mg$$

$$\frac{(61)(40.2)^2}{61} = F_N + (61)(9.8)$$

$$1616 = F_N + 597.8$$

$$1018.2 = F_N$$